PATENT ABSTRACTS OF JAPAN

(11)Publication number :   2000-022978

(43)Date of publication of application : 21.01.2000

(51)Int.Cl.	H04N 1/60
	G06T 5/00
	H04N 1/46

(21)Application number : 10-201319   (71)Applicant : RICOH CO LTD

(22)Date of filing :   01.07.1998   (72)Inventor : KOMATSU MANABU

   SUZUKI HIROAKI

(54) COLOR CORRECTING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To execute color corrections including the collapse of high-saturation and less-disorder color reproduction ranges as to color conversion between color image output devices different in color reproduction ranges.

SOLUTION: This device is equipped with a lightness conversion part 208 that performs a lightness converting process for matching a lightness range relatively and a color conversion part 209 that compresses a color which can not be reproduced even by performing the lightness converting process to a color within a color reproduction range by controlling the direction of compression by each color phase according to the while the lightness after the lightness converting process is used as a reference corresponding to the maximum saturation of each color phase of the image output device being the tangent of the color matching on the basis of the lightness. Further, a color which can not be reproduced even by matching the lightness range relatively and performing the lightness converting process is compressed to a color within the color reproduction range by controlling the direction of compression by each color phase according to the lightness while the lightness after the lightness converting process is used as a reference corresponding to the maximum saturation of each color phase of both image output devices to
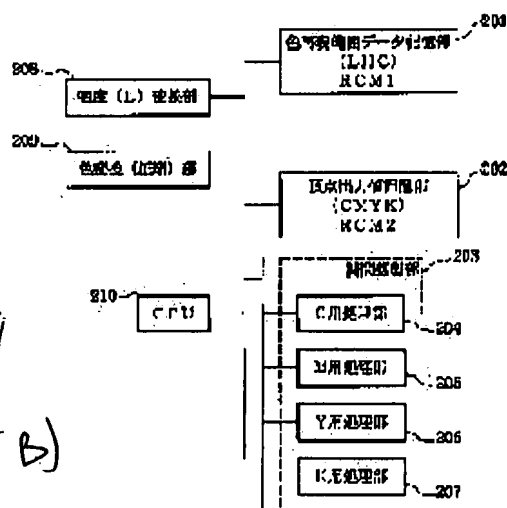
be color-matched to execute color correction including preferable correspondence within the color reproduction range.

LEGAL STATUS

[Date of request for examination]	24.12.2004
[Date of sending the examiner's decision of rejection]	11.04.2007
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	2007-013783
[Date of requesting appeal against examiner's decision of rejection]	11.05.2007
[Date of extinction of right]	

MENU **SEARCH** **INDEX** **DETAIL** **JAPANESE**

1 / 1

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the color correction equipment which changes an input color picture signal into the control signal of the output unit with which the color reproduction range was restricted.
[0002]
[Description of the Prior Art] Generally, when the color reproduction range and the color reproduction range of an output unit which an input color picture has conventionally since it is narrow differ from each other compared with color reproduction range, such as television and a CRT display, as for the color reproduction range in the printer of an electrophotography method, an ink jet printer, etc., many color correction approaches have been proposed. For example, to JP,4-40072,A, it judges whether it is outside the color reproduction range of an output destination change on uniform color space or a HVC color space (color space which consists of lightness, a hue, and information about saturation), and, in outside the color reproduction range, the color correction method characterized by lightness and the saturation with the same hue correcting and outputting to the greatest value is indicated. Moreover, by JP,61-288690,A, when the color reproduction range of an output system differs to an input system, the color picture art which sets a hue constant a core [the white point on a chromaticity diagram], and is characterized by carrying out the compression map of the point outside the color reproduction range of an output system at the point of color reproduction within the limits is indicated.
[0003]
[Problem(s) to be Solved by the Invention] However, in the above conventional techniques, it is uniform color space etc. like a JP,4-40072,A publication first. If the magnitude and the configuration of the color reproduction range differ from each other greatly like a CRT monitor and hard copy when compressing saturation, maintaining a hue and lightness in order to change into the control signal of the output unit with which the color reproduction range was restricted for example For example, there is a problem of ****, such as low thing red (Red) of the lightness which cannot reproduce an output unit, and high blue (Blue) of lightness, being lost. Moreover, by the technique of compressing lightness and saturation toward the white point etc. uniformly, and the technique compressed in the direction of color difference min, there was a problem which the saturation of the highlights section is too high, or crushing of high saturation produces about a certain color in natural images, such as a photograph, like a JP,61-288690,A publication. This invention is made in order to solve the trouble of the above conventional techniques, and it is set to claim 1. In the color conversion between the color picture output devices from which the magnitude of the color reproduction range differs Crushing of high saturation makes it a technical problem to offer the color correction equipment which can carry out color correction including matching of little color reproduction range, and sets to claim 2. The magnitude and the configuration of the color reproduction range make it the technical problem to offer the color correction equipment which can carry out color correction including desirable matching of the color reproduction range in the color conversion between greatly different color picture output devices.

[0004]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, color correction equipment according to claim 1 In the color inverter which changes the color picture information in the color picture output device of arbitration into the control signal of the color picture output device of arbitration with which color reproduction range differs As opposed to the lightness converter which performs lightness transform processing which sets a lightness range relatively, and a color unreproducible even if it performs lightness transform processing It is based on the lightness after said lightness transform processing corresponding to the highest saturation for every hue of an image output device used as the target of color matching. Crushing of high saturation enabled it to carry out color correction including matching of little color reproduction range by having the color converter which controls the direction compressed for every hue according to lightness, and is compressed to the color of color reproduction within the limits. Moreover, color correction equipment according to claim 2 is set to the color inverter which changes the color picture information in the color picture output device of arbitration into the control signal of the color picture output device of arbitration with which color reproduction range differs. As opposed to the lightness converter which performs lightness transform processing which sets a lightness range relatively, and a color unreproducible even if it performs lightness transform processing It is based on the lightness after said lightness transform processing corresponding to the highest saturation for every hue of the image output device of the both sides which do color matching. It enabled it to carry out color correction including desirable matching of the color reproduction range by having the color converter which controls the direction compressed for every hue according to lightness, and is compressed to the color of color reproduction within the limits.
[0005]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is concretely explained using a drawing. Drawing 1 is the explanatory view of the gestalt of operation at the time of making into an input color space the CIELAB color space which is a typical color space. When a CIELAB color space is made into an input color space so that it may illustrate, a CIELAB color space is divided into a solid figure (here cube) of the same kind. And in order to calculate the output value P which is an input and which can be set a coordinate (Lab value), a cube including the coordinate of said input is chosen and linear interpolation is carried out based on the location in the output value on the top-most vertices of eight points of the this chosen cube set up beforehand, and said cube of said input (distance from each top-most vertices). Here, when an input value is the control signal of 4 color printer, an output value P is equivalent to C, M, Y, and K value, respectively. Drawing 2 is the block block diagram of the color correction equipment in which the gestalt of operation of the 1st of this invention is shown. The color reproduction range storage section 201 remembered the color reproduction range data (Lightness L, the maximum saturation C to Hue H) of a printer to be in drawing 2 (ROM1), 202 is the top-most-vertices output-value storage section (ROM2) which memorized the control signal (C, M, Y, K) of the output unit corresponding to each top-most vertices on an input color space, these color reproduction range data and top-most-vertices output values are determined in advance, and each storage sections 201 and 202 are made to memorize them. 203 is the interpolation processing section and it becomes from the processing section 204 for C which carries out the interpolation operation of C, the processing section 205 for M which carries out the interpolation operation of M, the processing section 206 for Y which carry out the interpolation operation of Y, and the processing section 207 for K the interpolation operation of K carries [section] out with reference to the control signals C, M, Y, and K of the printer which is in the top-most-vertices output-value storage section 202 based on an input signal at the time of color-correction activation.
[0006] Moreover, 208 is based on the maximum lightness (it becomes the color of paper) and the minimum lightness of a printer. It is the lightness conversion (L compression) section which carries out compression processing of the lightness component (L*) of an input picture signal. 209 is the color conversion (compression) section which carries out compression processing to the color of color reproduction within the limits to a still unreproducible color after setting a lightness range relatively, and 210 is CPU which controls this whole color correction equipment. The color correction equipment

constituted as mentioned above operates as follows. First, it sets in the lightness conversion (L compression) section 208, for example, an input picture signal (referred to as Lab with the gestalt of this operation) is Lwhite and Lblack. Compression processing of the lightness component (L*) of an input picture signal like a degree type made into the maximum lightness (white point) and the minimum lightness (black point) of a printer is carried out.
L* =L* x(Lwhite-Lblack) /100+Lblack However, Lwhite : The maximum lightness of a printer (white point)
Lblack : the minimum lightness of a printer (black point) ... (1)
A compression means is not this limitation although linearity is compressed as an example in the example of a gestalt of this operation. Thus, the lightness value (L*) of the input picture signal by which lightness compression was carried out in the lightness conversion (L compression) section 208 is sent to the color conversion (compression) section 209 with a chromaticity value (a* b*), and is changed into Lightness L, Hue H, and the information on saturation C as follows.
lightness: -- L saturation: -- C; (a2 ten b2) 0.5 hue: -- H=atan2(b, a) x180/pi however, the time of a=b=0 -- H= 0 the time of H< 0 -- H= 3600 -- H ... (2)
the color reproduction range data (Lightness L --) of the printer which the color conversion (compression) section 209 has in this lightness L, Hue H, and the information on saturation C and the color reproduction range storage section 201 (ROM1) here When the maximum saturation C to Hue H is measured (the magnitude of the same lightness L and the saturation C to Hue H is compared) and input data is in the interior of the color reproduction range When delivery and input data are in the interpolation operation part 203 in the exterior of the color reproduction range about data (L, a, b) then Hue H refers to the color reproduction range data (the highest saturation C) of said printer corresponding to lightness L' after L conversion on the basis of the lightness corresponding to the highest saturation for every hue of an image output device (for example, monitor) used as the target of color matching, saved, it changes into the color (LHC->L'a'b') of the color reproduction range of a printer, and data (L', a', and b -- ') are sent to the interpolation operation part 203. As shown in drawing 3 , specifically the data outside the color reproduction range As opposed to a color with lightness higher than the lightness corresponding to the highest saturation of an image output device (for example, monitor) used as the target of color matching ((Every) A hue) The direction compressed in the fixed direction is controlled according to lightness. a hue -- it is fixed and lightness becomes high -- alike -- following -- the lightness from the direction of color difference min -- As opposed to a color with lightness lower than the lightness corresponding to the highest saturation of an image output device (for example, monitor) used as the target of color matching ((Every) A hue) a hue -- it is fixed and lightness becomes low -- alike -- following -- the lightness from the direction of color difference min -- the direction compressed in the fixed direction will be controlled according to lightness, and it will compress to the color of the color reproduction range of an output unit.
[0007] If the above-mentioned processing is expressed with a formula, it can express as follows.
C'=gamut C (H and LK)
It is LK =LEmin+(LEmin-Lconst) x(L-LSmax)/(LW-LSmax) at the time of L>LK (L Smax). It is LK =Lconst+(Lconst-LEmin) x(LSmax-L)/(LSmax-LB) at the time of L<LK (LSmax).
However, gamut C (H, L) is the hue H of arbitration, and the color reproduction range (the highest saturation C) of the output unit (printer) in Lightness L.
LSmax : -- lightness LLEmin corresponding to the maximum station saturation of each hue of an image output device (monitor) used as the target of color matching : LLconst of the color reproduction range of an input and the output unit (printer) of color difference min : an input and lightness -- L (=L) of the color reproduction range of a fixed output unit (printer)
LW: -- highest lightness LB: of an output unit (printer) -- the minimum lightness interpolation operation part 203 of an output unit (printer) -- the processing section 204 for C, and M -- business -- in the processing section 205, the processing section 206 for Y, and the processing section 207 for K, transform processing by the interpolation which referred to the control signal (top-most-vertices output value) of the printer in the top-most-vertices output-value storage section (ROM2) 202 is carried out,

and it is transmitted to an output unit. In addition, L* a* b* which measured the relation of actual I/O (LAB-CMYK) on the coordinate on the input space used for a interpolation operation (L* a* b*), and was computed with the least square method etc. on it using this data at that time The value of C, M, Y, and K to a value is set up beforehand.

[0008] Drawing 4 is the block block diagram of the color correction equipment in which the gestalt of operation of the 2nd of this invention is shown. The color reproduction range storage section 401 remembered the color reproduction range day evening (a* b* corresponding to lightness and the maximum saturation to a hue value) of a printer to be in drawing 4 (ROM1), The highest saturation (lightness) storage section 402 remembered the lightness corresponding to the highest saturation for every hue of a printer to be (ROM2), 403 is the top-most-vertices output-value storage section (ROM3) which memorized the control signal (C, M, Y, K) of the output unit corresponding to each top-most vertices on an input color space, these data are determined in advance and each storage sections 401, 402, and 403 are made to memorize them. 404 is the interpolation processing section and it becomes from the processing section 405 for C which carries out the interpolation operation of C, the processing section 406 for M which carries out the interpolation operation of M, the processing section 407 for Y which carry out the interpolation operation of Y, and the processing section 408 for K the interpolation operation of K carries [section] out with reference to the control signals C, M, Y, and K of the printer which is in the top-most-vertices output-value storage section 403 based on an input signal at the time of color-correction activation. 409 is the lightness conversion (L compression) section which carries out compression processing of the lightness component (L*) of an input picture signal based on the maximum lightness (it becomes the color of paper) and the minimum lightness of a printer. Moreover, 410 After setting a lightness range relatively, it is the color conversion (compression) section which carries out compression processing to the color of color reproduction within the limits to a still unreproducible color, and 411 is CPU which controls this whole color correction equipment.

[0009] The color correction equipment constituted as mentioned above operates as follows. First, it sets in the lightness conversion (L compression) section 409, for example, an input picture signal is Lwhite and Lblack. Compression processing of the lightness component (L*) of an input picture signal made into the maximum lightness (white point) and the minimum lightness (black point) of a printer is carried out (formula 1 reference). Thus, the lightness value (L*) of the input picture signal by which lightness compression was carried out in the lightness conversion (L compression) section 409 is sent to the color conversion (compression) section 410 with a chromaticity value (a* b*), and is changed into Lightness L, Hue H, and the information on saturation C (formula 2 reference). the color reproduction range data (Lightness L --) of the printer which the color conversion (compression) section 410 has in this lightness L, Hue H, and the information on saturation C and the color reproduction range storage section 401 (ROM1) here When the maximum saturation C to Hue H is measured (the magnitude of the same lightness L and the saturation C to Hue H is compared) and input data is in the interior of the color reproduction range When it is in the interpolation operation part 404 in delivery and the exterior about data (L, a, b) then Hue H refers to the color reproduction range data (the highest saturation C) of said printer corresponding to lightness L' after L conversion on the basis of the lightness (it memorizes to ROM2) corresponding to the highest saturation for every hue of a monitor and a printer which carries out color matching, saved. it changes into the color (LHC->L'a'b') of the color reproduction range of a printer, and data (L', a', and b -- ') are sent to the interpolation operation part 404.

[0010] As shown in drawing 5 , specifically the data outside the color reproduction range As opposed to a color with lightness higher than the lightness (in the case of the monitor L> printer L) corresponding to the highest saturation for every hue of a monitor Extensive **** control of the direction compressed in the fixed direction is carried out at lightness. a hue -- it is fixed and lightness becomes high -- alike -- following -- the lightness from the direction of color difference min -- As opposed to a color with lightness lower than the lightness (in the case of the monitor L> printer L) corresponding to the highest saturation of a printer ((Every) A hue) a hue -- it is fixed and lightness becomes low -- alike -- following -- the lightness from the direction of the color difference minimum -- the direction compressed in the fixed direction will be controlled according to lightness, and it will compress to the color of the color

reproduction range of an output unit. If the above-mentioned processing is expressed with a formula, it can express as follows.

C'=gamut C (H and LK)

(in the case of LSmon >L-Sprint)

L>LSmon At the time LK =LEmin+(LEmin-Lconst) x(L-LSmon)/(LW-LSmon) LSprint <L<LSmon At the time LK =LEmin L<LSprint At the time LK =Lconst+(Lconst-LEmin) x(LSprint-L)/(LSprint-LB)

(in the case of LSmon <LSprint)

L>LSprint At the time LK =LEmin+(LEmin-Lconst) X(L-LSprint)/(LW-LSprint)

LSmon <L<L-Sprint At the time LK =LEmin L<LSmon At the time LK =Lconst+(Lconst-LEmin) x (LSmon-L)/(LSmon-LB)

gamut C (H, L) However, the hue H of arbitration The output unit in Lightness L the color reproduction range of a (printer) (the highest saturation C) LSmon : The lightness L corresponding to the highest saturation of each hue of a monitor LSprint : Lightness L corresponding to the highest saturation of each hue of a printer LEmin : L of the color reproduction range of an input and the output unit (printer) of **** min Lconst : an input and lightness -- L (=L) of the color reproduction range of a fixed output unit (printer)

LW: The highest lightness of an output unit (printer) LB: The minimum lightness of an output unit (printer) ... (5)

In the interpolation operation part 404, in the processing section 405 for C, the processing section 406 for M, the processing section 407 for Y, and the processing section 409 for K, transform processing by the interpolation which referred to the control signal (top-most-vertices output value) of the printer in the top-most-vertices output-value storage section (ROM3) 403 is carried out, and it is transmitted to an output unit.

[0011]

[Effect of the Invention] As explained above, this invention does the following outstanding effectiveness so. In the color inverter which changes a control signal in order to take color matching between the color picture output devices from which the magnitude of the color reproduction range differs according to the color correction equipment concerning invention according to claim 1 As opposed to a color unreproducible even if it performs lightness transform processing which sets a lightness range relatively, and lightness transform processing It is based on the lightness after lightness transform processing corresponding to the highest saturation for every hue of an image output device used as the target of color matching. Since it constituted so that color transform processing which controls the direction compressed for every hue according to lightness, and is compressed to the color of color reproduction within the limits might be performed, the color correction including matching of little color reproduction range of crushing of the high saturation corresponding to the property of an image output device used as the target of color matching becomes possible. In the color inverter which changes a control signal in order to take color matching between the color picture output devices from which the magnitude and the configuration of the color reproduction range differ greatly according to the color correction equipment concerning invention according to claim 2 As opposed to a color unreproducible even if it performs lightness transform processing which sets a lightness range relatively, and lightness transform processing It is based on the lightness after lightness transform processing corresponding to the highest saturation for every hue of the image output device of the both sides which do color matching. Since it constituted so that color transform processing which controls the direction compressed for every hue according to lightness, and is compressed to the color of color reproduction within the limits might be performed, color correction including desirable matching of the color reproduction range becomes possible.

[Translation done.]